

## PRELIMINARY RESULTS REGARDING NATURAL TENDENCY OF FEATHERING AND GROWTH HABITS OF SOME APPLE SCION-ROOTSTOCK COMBINATIONS, IN THE NURSERY

### REZULTATE PRELIMINARII PRIVIND TENDINȚA NATURALĂ DE EMITERE A LĂSTARILOR ANTICIPATI ȘI PARTICULARITĂȚILE DE CREȘTERE A UNOR COMBINAȚII SOI-PORTALTOI ÎN PEPINIERĂ, LA SPECIA MĂR

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**Abstract.** *There were studied several scion cultivars in the nursery regarding natural tendency of feathering at Fruit Research and Development Station Bistrita in 2015. The goal of the study was to assess the natural behavior of forming preformed shoots of several scion-rootstock combinations in the first year after grafting. Several researches showed that not only grafted scion has a direct effect on the sylleptic branching of fruit trees and feathering but also the rootstock has an important influence. The studied scion-rootstock combination were: Florina/M106, Florina/M26, Jonathan/M106, Jonathan/M26. Results indicate that the hypothesis that not only the cultivar but also the rootstock influences the emergence of the feathers is confirmed, medium to strong vigor rootstock M106 induces feathering on Florina cultivar naturally (average number of 3.13 shoots), probable the more complex and dense root system provides sufficient nutrients in order to promote lateral branching. Medium feathering was observed also at Starkprim cultivar on M106 rootstock (2,8 shoots), not included in the statistical analysis but observed in singular combination, showed high sylleptic shoot formation. Even more sylleptic shoots were formed in the vigorous combination of Auriu de Bistrita cultivar on M106 (3,8 shoots) also not included in the analysis in this experimental phase. Based on these results in further researches using agro-technical methods like pinching in optimum time intervals, foliar fertilizing and other techniques we will study and develop good feathered trees with more lateral shoots and strong root system in order to provide quality planting material for farmers.*

**Key words:** *scion, rootstock, grafting, feathers, shoots, lateral branching, insertion angle, planting material*

**Rezumat.** *Au fost efectuate studii privind emiteră naturală de lăstări anticipați în pepinieră, la Stațiunea de Cercetare-Dezvoltare pentru Pomicultură Bistrița în anul 2015. Obiectivul studiului a fost de a evalua tendința naturală de formare a lăstarilor anticipați la unele combinații soi-portaltoi în primul an după altoire. Combinațiile soi-portaltoi au fost Florina/M106, Florina/M26, Jonathan/M106, Jonathan/M26. Rezultatele indică faptul că, se confirmă ipoteza ca nu numai soiul dar și portaltoiul influențează emiteră de lăstari*

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*anticipați, portaltoiul mediu-viguros M106 a influențat emiterea de lăstari anticipați la soiul Florina în mod natural (număr mediu de lăstari 3.13), cel mai probabil datorită sistemului radicular mai complex și mai dens care furnizează suficienți nutrienți din sol pentru favorizarea emiterii lăstarilor anticipați. O lăstărire laterală medie a fost observat și la soiul Starkprim pe portaltoiul M106 (2.8 lăstari), acesta nu a fost inclus în studiul statistic dar s-au efectuat observații în combinații individuale, portaltoiul favorizând apariția de lăstari anticipați la acest soi. S-a observat o mai pronunțată emiterie de lăstari anticipați la soiul Auriu de Bistrița altoit pe portaltoiul M106 (3,8 lăstari anticipați) acesta de asemenea nu s-a inclus în analiza statistică în această fază experimentală. Bazat pe aceste observații utilizând metode agrotehnice ca ciupitul frunzelor efectuat în intervale de timp optime, fertilizări foliare și alte tehnici, vom studia și produce pomi fructiferi cu mai mulți lăstari anticipați preformați cu un sistem radicular puternic pentru a furniza material de plantare de calitate fermierilor.*

**Cuvinte cheie:** soi, portaltoi, altoire, lăstari anticipați, lăstărire laterală, unghi de inserție, material de plantare

## INTRODUCTION

Fruit tree planting material quality depends primarily on good developed root system, trunk and a number of well developed preformed shoots with wide insertion angles (Wertheim and Webster, 2003). Nursery planting material can be found in two categories, trees without preformed shoots and trees with lateral branches with 3-4 rarely 5 shoots, called feathers. The importance of the feathers is crucial, a reduced number of preformed shoots or the inexistence of them has the influence of lately bearing of the new orchards (Robinson, 2007). Extensive research was carried out in several countries to investigate the methodology to induce feathers, using plant hormones like cytokinins (BA-benzyladenine) and gibberellins GA4+7 (giberellic acid) or agro-technical methods like pinching and foliar fertilizations to brake the apical dominance and to induce feathering (Hrotko *et al.* 1996; Magyar *et al.*, 2008; Gudarowska, 2004; Dragan Radivojevic *et al.*, 2015; Csiszar and Buban, 2004) but there are few articles regarding the natural behavior of cultivars and rootstocks in the nursery regarding feathering. The number of shoots and the length of shoots influences the yield per tree (Pietranek *et al.*, 2006) together with the insertion angles of branches along with the ecological factors like temperature of soil, atmospheric humidity, air temperature, the existent macro and micro elements in the soil thus the ecological factors of the orchards (Tromp, 1996). The apple cultivars have different capacity to promote sylleptic lateral branching. First shoots of the trees will provide future elements for flowering, developing branching system for vegetative system. Research on scion-rootstock interaction showed that rootstock influences the growth rate of shoots. Also there were observed that rootstocks have not only the size controlling effect but also the effect on scion shoot growth. The goal of the present experiment was to observe the natural behavior of some scion cultivars and the influence of rootstocks regarding the growth habit, number of shoots, insertion angles of shoots in the first growth year after grafting. The hypothesis of the

research was that both of the two factors have a direct influence on feathering, cultivar and rootstock. Research will provide information which part of the scion-rootstock combination influences the natural feathering of trees.

## MATERIAL AND METHODS

Researches were effectuated at the Nursery of Fruit Research and Development Station Bistrita located in Bata village, Bistrita-Nasaud county, Romania, near Dej city. The nursery is located near Somes river, soil conditions were optimum, establishment was on a sandy-loam site, well drained, with optimum thermal and rainfall conditions in 2015. The experiment followed a completely randomized block design with 3 repetitions per variant. Factor A was represented by cultivar type (Florina, Jonathan) and factor B was represented by rootstock type (M106, M26). Florina and Jonathan apple cultivars were grafted in 2014 on M106 medium to strong vigor rootstock and M26 medium vigor rootstock.

At the final period of the growth period in 2015 there were counted number of shoots, length of shoots and measured the shoot growing angle. The registered data was statistically analyzed by the analysis of variance test using Excel 2003 add on Daniel's Toolbox statistical software.

## RESULTS AND DISCUSSIONS

### Research results regarding number of shoots in natural feathering

The observations in the research plot regarding the natural feathering of the cultivars due to factor cultivar alone showed no particular distinctive differences, it seems that the few number of the preformed shoots was not influenced by the two cultivars Florina and Idared. Average values of the counted shoots showed that in both cultivars 2-3 shoots were formed at M106 rootstock combination (Fig. 1), while in M26 grafting combination just 1-2 shoots were formed (Table 1). The values regarding number of shoots in both factors were close each other. On the other hand the factor B –rootstock influenced very significantly ( p value 0.0003) the scion-rootstock combination (Table 2). The interaction between the rootstocks and cultivars showed also significance ( p value 0.0174).

Table 1  
Average number of shoots of the studied scion-rootstock combinations at FRDS Bistrita in 2015

| Cultivar | Rootstock |      |
|----------|-----------|------|
|          | M106      | M26  |
| Florina  | 3.13      | 1.67 |
| Jonathan | 2.27      | 1.93 |

Table 2  
Analysis of variance regarding number of shoots in natural feathering

| Computation | SS   | DF | MS   | F    | P                |
|-------------|------|----|------|------|------------------|
| Total       | 63.3 | 59 | 1.1  |      |                  |
| Factor A    | 1.4  | 1  | 1.4  | 1.7  | 0.1999           |
| Factor B    | 12.2 | 1  | 12.2 | 15.1 | <b>0.0003***</b> |
| Interaction | 4.8  | 1  | 4.8  | 6.0  | <b>0.0174*</b>   |
| Res. Error  | 44.9 | 56 | 0.8  |      |                  |



Fig.1 - Natural tendency of feathering in the fruit nursery, Idared cultivar/M106 rootstock

### Research results regarding length of shoots in natural feathering

Studying the average length of shoots it appears that in both of the cultivars at the M106 more vigorous shoots were formed (23.90-24.62 m) than on the M26 rootstock (13.28-19.3 cm) (Table 3).

Table 3

**Average length of shoots (cm) of the studied scion-rootstock combinations at FRDS Bistrita in 2015**

| Cultivar | Rootstock |       |
|----------|-----------|-------|
|          | M106      | M26   |
| Florina  | 24.62     | 13.28 |
| Jonathan | 23.90     | 19.3  |

Length of shoots it is influenced not only by cultivar but also by rootstock it appears in the following research ( table 4). The M106 and M26 rootstocks had a strong influence on the length of shoots, factor B being very significant (p-value 0.0002).

Table 4

**Analysis of variance regarding length of shoots in natural feathering**

| Computation | SS     | DF | MS    | F    | P                |
|-------------|--------|----|-------|------|------------------|
| Total       | 4591.4 | 59 | 77.8  |      |                  |
| Factor A    | 105.2  | 1  | 105.2 | 1.8  | 0.1911           |
| Factor B    | 953.3  | 1  | 953.3 | 15.9 | <b>0.0002***</b> |
| Interaction | 169.9  | 1  | 169.9 | 2.8  | 0.0982           |
| Res. Error  | 3363.1 | 56 | 60.1  |      |                  |

### Observations regarding insertion angles of shoots

Table 5

**Insertion angles of shoots (°) of the studied scion-rootstock combinations at FRDS Bistrita in 2015**

| Cultivar | Rootstock |     |
|----------|-----------|-----|
|          | M106      | M26 |
| Florina  | 55        | 45  |
| Jonathan | 50        | 48  |

The insertion angle of the cultivars were between 50-55 ° at M106 rootstock combinations (fig.2) and slightly sharp angles at M26 rootstock combinations, general observation being that in the first year after grafting sharp and narrow angles of feathers are formed.



**Fig. 2** - Insertion angles (50-55 ° ) of the new feathers at Idared cultivar / M106 rootstock

Analyzing the registered data it appears that the rootstocks M106 and M26 influences strongly the rootstock-scion combinations, higher number of roots in M106 and a diverse and strong root system influences more nutrient uptake thus the easier braking of apical dominance and the forming of new lateral shoots depends also on the type of rootstock. Rootstock M26 has a medium root system, the mineral uptake possibility is reduced in comparison with M106 rootstock which has a strong root system, sylleptic shoot formation being more pronounced in M106 combinations.

## CONCLUSIONS

1. The effectuated observations showed that natural feathering of apple cultivars is influenced not only by scion but also definitely by rootstocks also. In the experiment no significant influence of the cultivars was observed regarding the number of shoots, it seems that the natural habit of feathers formation of the two studied cultivars in 2015 was quite the same.

2. The use of medium to strong rootstock M106 and medium vigor rootstock M26 induced the natural appearance of 2-3 shoots. The length of the feathers were 23-24 cm at M106 rootstock and 13-19 cm at M26, rootstocks influencing the scion-rootstock combination.

3. Further researches will be carried out in order to assess and understand other cultivars natural tendency of feathering in different scion-rootstock combinations and there will be applied agro-technical methods to improve the natural feathering of nursery fruit trees and produce healthy, quality planting material.

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